Space Weather Technical Forecast

Issued on Thursday, 11 July 2024 at 01:23 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: M-class flares (R1-R2; Minor-Moderate radio blackouts) likely throughout. Chance of G1/Minor Storm intervals days 2 and 3 (12-13 Jul).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was Moderate after five recent M-class flares, peaking at M1.5 at 10/0559 UTC from AR3738. There are nine regions visible on the disc. AR3738 in the south transiting across centre disk, is by far the largest and most complex region visible, showing a continued growth trend in penumbral area in its intermediate spots, with a delta magnetic configuration also present here. The only other spot of note is AR3743 in the southeast, it has also developed intermediate spots, but remains magnetically simple. The remaining spots are all small and stable or showing a declining trend.

No significant Earth-directed CMEs have been observed during the past 24 hours, though several dimming events occurred near AR3738 associated with low level M class flares, but no discernible CMEs were observed.

Solar Wind / Geomagnetic Activity: Solar winds as observed by ACE at L1 were indicative of background conditions, perhaps with weak negative coronal hole influences. Speeds were slow-ambient to slightly elevated, around 350-420 km/s. Density was below average. The Interplanetary Magnetic Field, Bt, was weak, below 7nT. The north-south component, Bz, varied weakly between +5/-5nT. The phi angle was mostly negative (toward the Sun). The resulting geomagnetic activity was Quiet (Kp 1-2).

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux observed by GOES18 remained at background levels. High energy electron flux (greater than 2MeV) observed by GOES16 was at mostly background levels. The 24-hour fluence was below Active, with 1.93e6 integrated pfu observed at 11/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be at Low to Moderate levels, with a slight chance of becoming High from any isolated X-class flares, which are most likely to originate from the large, centre-disc sunspot region, AR3738.

Solar Wind / Geomagnetic Activity: No significant Earth-directed CMEs feature in the forecast. The solar wind should start at background, but rise to slightly elevated on day 1 (11 Jul), due to weak negative polarity coronal hole high speeds streams. During day 2 or 3 (12-13 Jul) a further, likely faster and perhaps more impactful coronal hole high speed stream is expected to arrive bringing elevated solar wind speeds. Waning coronal hole effects are anticipated on day 4 (14 Jul), with speeds falling back to slightly elevated or slow-ambient.

Geomagnetic activity is expected to be mainly Quiet to Unsettled (Kp 1-3) initially with a chance of Active intervals upon the connection to the weak southern coronal hole high speed streams. There is then a Chance of G1/Minor storm intervals (Kp 5) on days 2 and 3 (12-13 Jul), due to the anticipated connection to the stronger northern coronal hole high speed stream. By day 4 (14 Jul), geomagnetic activity should fall back to Quiet to Active (Kp 1-4).

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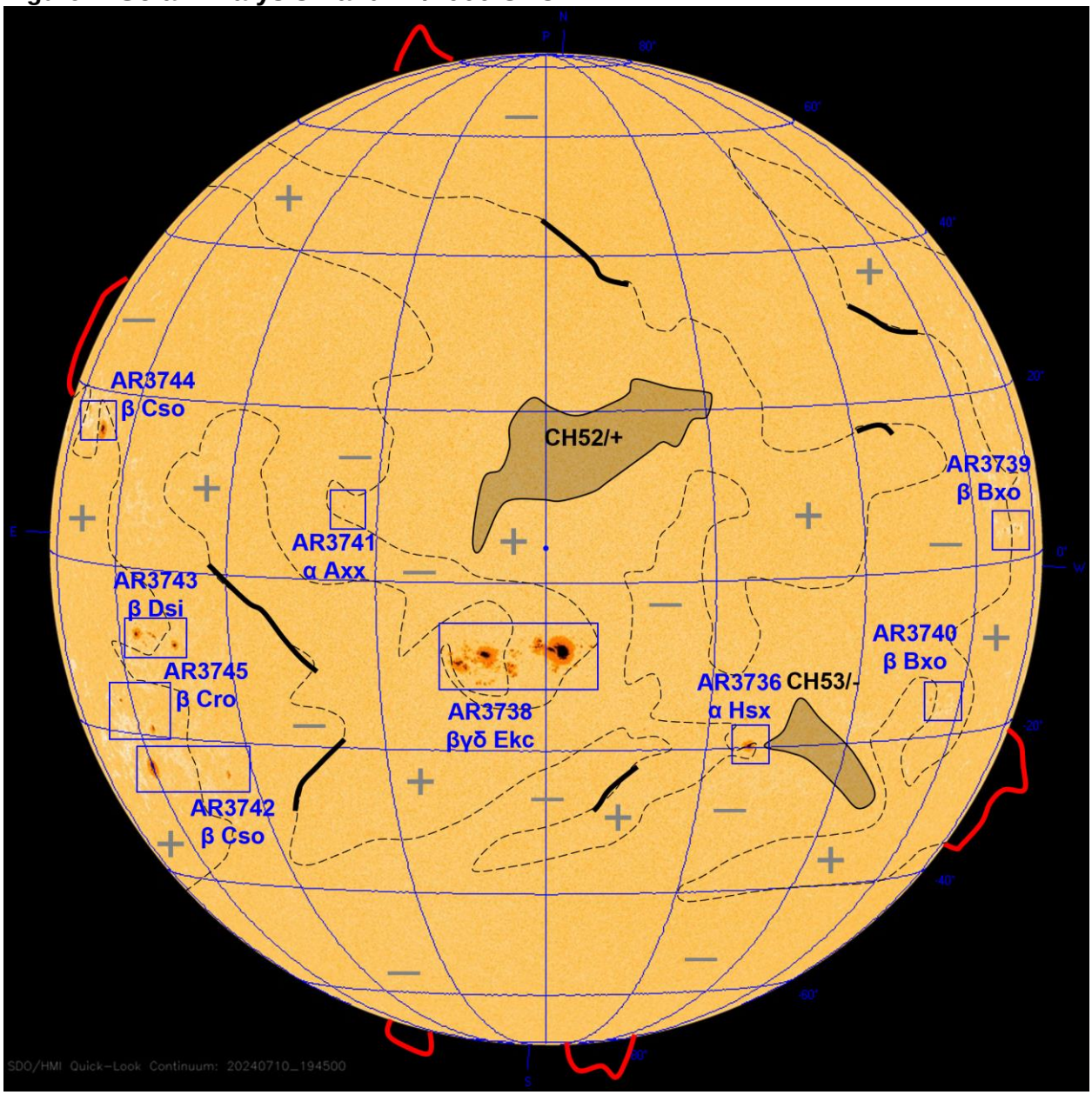
Energetic Particles / Solar Radiation: Solar radiation storms are not expected, but there is a very slight chance of reaching S1/Minor Radiation Storm or greater levels. This risk increases a little later in the period as AR3738, currently in centre disk, rotates towards the southwest and into a more geoeffective position.

High energy electron flux is expected to remain mostly at background levels through this period, with the Active (1e8 integrated pfu) fluence threshold not expected to be reached.

Figure 1. Solar Analysis Valid 11/2000 UTC



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No anticipated Earth-directed CMEs feature in the forecast.

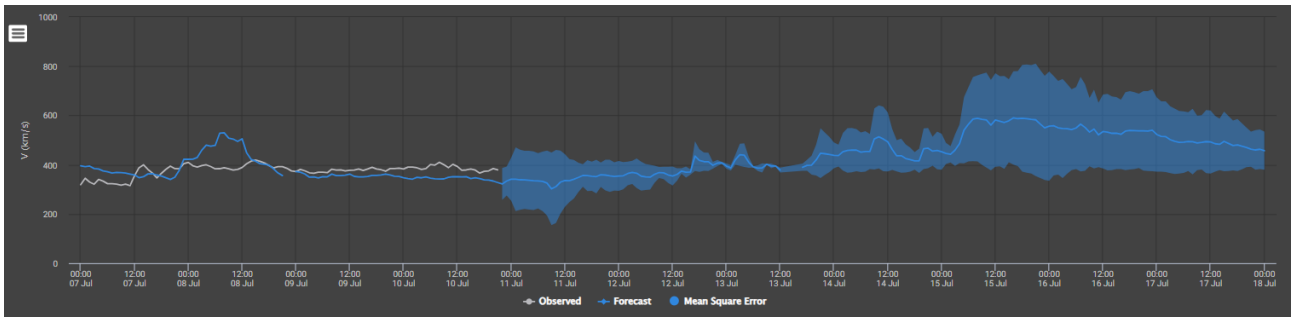
Solar winds are expected to start at slow-ambient levels. Two successive negative coronal holes in the southwest may bring more general slightly elevated wind speeds through day 1 until early day 2 (11-12 Jul). Significant geomagnetic activity from either of these features is considered unlikely due to their ill-defined appearance and Earth's proximity to the solstice.

A prominent and large, positive coronal hole (CH52/+) is currently transiting across centre disk in the northern hemisphere. This coronal hole High Speed Stream (HSS) is likely to connect with Earth on the second half of day 2 or into day 3 (12-13 Jul), with solar winds probably reaching elevated levels, to around 500-600 km/s. This feature is dark in appearance and well defined alluding to the fast wind emanating from this coronal hole to be the most significant of any coronal holes currently on the disk. This HSS may last around two days with a gradual decline expected once the peak has occurred.

Geomagnetic activity is expected to be mainly Quiet to Unsettled (Kp 1-3) initially with a chance of Active intervals upon the connection to the weak southern coronal hole high speed streams. There is then a Chance of G1/Minor storm intervals (Kp 5) on days 2 and 3 (12-13 Jul), due to the anticipated connection to the stronger northern coronal hole high speed stream. By day 4 (14 Jul), geomagnetic activity should fall back to Quiet to Active (Kp 1-4).

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	10	40	30	20
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: MOSWOC SWPM forecast



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Radio Blackouts - X-Ray Flares:

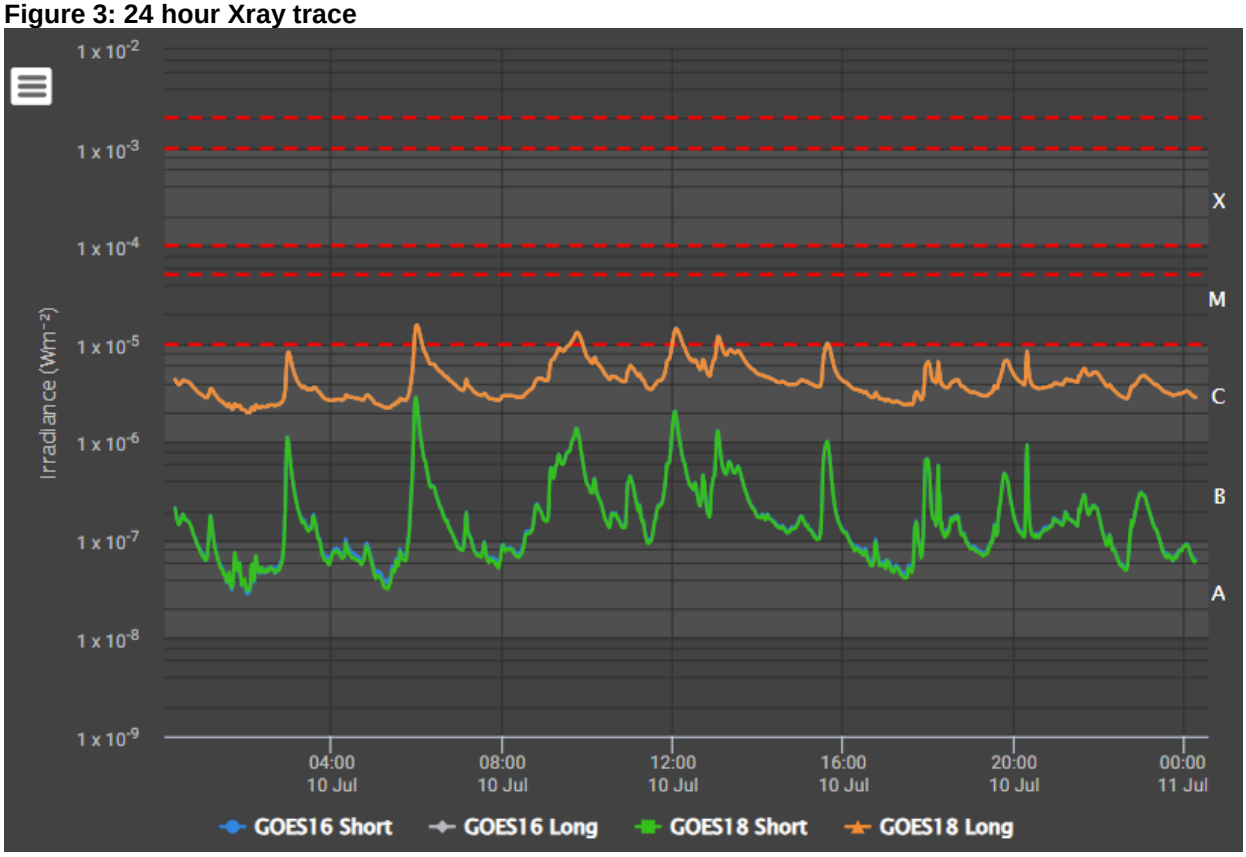
Solar activity is Moderate after five recent M-class flares, peaking at M1.5 at 10/0559 UTC from AR3738.

There are nine regions visible on the disc. AR3738 in the south transiting across centre disk, is by far the largest and most complex region visible, showing a continued growth trend in penumbral area in its intermediate spots, with a delta magnetic configuration also present here. The only other spot of note is AR3743 in the southeast, it has also developed intermediate spots in recent hours, but remains magnetically simple. The remaining spots are all small and stable or showing a declining trend.

Further M-class flares are considered likely, with a slight chance of an isolated X-class flare, mainly from AR3738.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	60	60	60	60
Very Active	R3 to R5 X Class	No	15	15	15	15

Figure 3: 24 hour Xray trace



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Solar Radiation Storms - (High Energy Protons):

High energy proton flux at GOES18 is at background levels. It is most likely to remain, but with a slight chance of exceeding the S1/Minor radiation storm threshold should any larger flares occur, mainly from AR3738. Considering the region is currently centre disk, it is still in an unfavourable location for significant proton enhancements to be detected at Earth following any notable flares. As the region rotates towards the southwest, the probability of exceeding S1 increases slightly, but still remains at a slight chance.

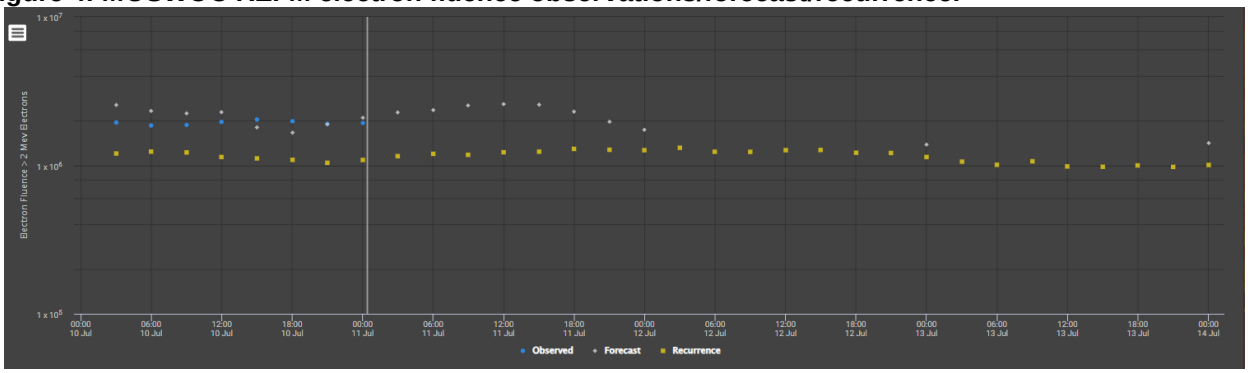
Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	10	10	15	20
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux recorded at GOES16 has been at mostly background levels and is expected to remain that way for much of the forecast period. Later in the period, the arrival of coronal hole fast winds may serve to suppress and charge the Van Allen belts, perhaps leading to a rise in flux towards the end of this forecast period. MOSWOC REFM output is considered good guidance, with a generally flat trend indicated through the period, well below the Active 1e8 integrated flux threshold.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	5	10
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: MOSWOC REFM electron fluence observations/forecast/recurrence.



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